Economics 466
Final Exam, Spring 2004
Total Points: 100, Time 2 hrs

Answer all questions. Note that each question has different weight. **Good Luck!**

1. Consider the following model:

$$Y = \beta_0 + \beta_1 X + \beta_2 D_2 + \beta_3 D_3 + u \qquad (1)$$

where Y is annual income, X is years of experience, D_2 =1 if Harvard MBA, D_3 =1 if Wharton MBA. The reference group is a Binghamton MBA.

(a) How would you interpret the coefficients of the above model? What do you expect the signs of β_2 and β_3 to be? How would you test the hypothesis that (i) $\beta_2 = 0$? and (ii) $\beta_2 = \beta_3$? **(4+4+3 points)**

Now consider the model

$$Y = \beta_0 + \beta_1 X + \beta_2 D_2 + \beta_3 D_3 + \beta_4 X * D_2 + \beta_5 X * D_3 + u \qquad (2)$$

(b) What is the difference between this model and the one in (1)? Interpret the coefficients of this model. How would you test the hypothesis that $\beta_4 = \beta_5$? If you accept this hypothesis what does your model mean? **(6+4+3 points)**

2. Suppose you are attempting to regress a model

$$Y_t = \beta_0 + \beta_1 X_t + u_t \qquad (3)$$

where $u_t = \rho \cdot u_{t-2} + \varepsilon_t$, which is realistic if one were using semi-annual data. Suppose you have 10 observations and that you know ρ.

   a) What is the appropriate transformation of your data if you want to correct for autocorrelation using the Cochrane-Orcutt procedure? **(5 points)**
   b) If ρ was not known explain step by step how you would first estimate it and then estimate the parameters in (3). **(6 points)**
   c) How would you test the model to see if there was no autocorrelation? **(4 points)**

3. Please specify whether the following statements are True, False, or Uncertain, being sure to specify why you made your claim. **(5 points each)**

   a) If D takes the values of (0, 2) instead of (0, 1), the value of β_2 in the regression $Y = \beta_1 + \beta_2 D + u$ will be halved?
   b) As your sample size gets larger, *t*-statistics should increase.
   c) If one rejects the null hypothesis under a one sided alternative using a ***t-test*** then one would most definitely reject the null under a two sided alternative.

d) I ran two models one with *y* as the dependent variable and one with ln *y* as the dependent variable and found the R^2 from the first regression to be higher. I conclude that the first regression must be better than the second by this criterion.

4. Suppose that the true regression model is

$$Y = \beta_0 + \beta_1 X + \beta_2 Z + u$$

and you have data on Y and *X*, but unfortunately there is no data on the *Z* variable. Your objective is to get a consistent estimator of β_1. What should you do? **(Bonus question: 10 points)**

5. Suppose you regress family weekly food expenditure (E) on family income (Y) and family size (F), and find that the estimated coefficient on Y is negative.

   (a) Do you agree with the negative coefficient on Y? **(3 points)**

   (b) Your friend suggested that the variance of the error term is a function of Y. i.e., $\text{var}(u_i) = \sigma^2 F_i$ and you should take care of this. Assuming that she is right, how would estimate the model to avoid heteroskedasticity. **(8 points)**

   (c) How can you test whether your friend is right? **(5 points)**

6. Consider the following system of demand and supply equations:

$$\textit{Demand}: \quad Q = \alpha_1 P + \alpha_2 Z_1 + u_1 \qquad (1)$$
$$\textit{Supply}: \quad Q = \beta_1 P + \beta_2 Z_2 + u_2 \qquad (2)$$

where Q and P are random endogenous variables.

a) Show that both the equations are identified. **(5 points)**
b) Show that the reduced form equations are: **(10 points)**

$$Q = \pi_{11} Z_1 + \pi_{12} Z_2 + v_1 \qquad (3)$$
$$P = \pi_{21} Z_1 + \pi_{22} Z_2 + v_2 \qquad (4)$$

where

$$\pi_{11} = -\frac{\beta_1 \alpha_2}{\alpha_1 - \beta_1}, \pi_{12} = \frac{\beta_2 \alpha_1}{\alpha_1 - \beta_1}, \pi_{21} = -\frac{\alpha_2}{\alpha_1 - \beta_1}, \pi_{22} = \frac{\beta_2}{\alpha_1 - \beta_1}$$

$$v_1 = \frac{\alpha_1 u_2 - \beta_1 u_1}{\alpha_1 - \beta_1}, v_2 = \frac{u_2 - u_1}{\alpha_1 - \beta_1}$$

c) You estimate (3) and (4) using OLS and the coefficients $\pi_{11}, \pi_{12}, \pi_{21}$, and π_{22} are found to be –1, -0.6, -0.5 and 1.2, respectively. Use these results to obtain estimates of the parameters in (1) and (2). **(10 points)**